(C) REMARKS

Please reconsider the application in view of the above amendments and the following remarks.

1. Request for Continued Examination

This Reply is the submission required with a Request for Continued Examination pursuant to 37 CFR § 1.114

2. Telephone Interview

The Applicant would like to thank the Examiner for courtesies in a telephone interview on January 17, 2006. In the interview, the Applicant and the Examiner discusses whether amendment of claim 1 to recite that the residual velocity analysis is performed entirely and/or directly, or substantially similar feature would overcome anticipated by the Ahmed publication. Applicant agreed to present amendment to claim 1 that would exclude the possibility of performance of residual velocity analysis in any other domain. Applicant believes that the amendment to claim 1, namely stating that the residual migration velocity analysis includes calculating depth residuals with respect to offset, is responsive to the basis for the previous rejection of the claims.

3. Claim rejections - 35 U.S.C. § 102(a)

Claims 1-6 stand finally rejected as anticipated by I. Ahmed, *Residual Migration Velocity Analysis in the Offset-Depth Domain*, J. Geophy. Expl. 12, 237-257 (2003) ("Ahmed"). To the extent the rejection may apply to claim 1 as amended, the Applicant respectfully traverses the rejection for the following reasons. Ahmed does disclose a method for performing migration velocity analysis ultimately in the offset-depth domain. However, with respect to claim 1 at least, the Applicant's invention is a method for performing such residual velocity analysis based on one or more selected horizons in the seismic data. Claim 1 as amended specifically recites selecting at least one horizon in the seismic data and performing residual velocity analysis in the offset-depth domain at the at least one horizon, wherein the analysis includes calculating depth residual with respect to offset.

The foregoing element of Applicant's claim 1 as amended is explained in the specification starting at paragraph [0028] where a relationship between offset and ray parameter is explained with reference to Equation (3). In Equation (4), a relationship between ray parameter and offset is determinable by virtual inversion of Equation (3). Substitution of the ray parameter-offset relationship of equation (4) into the residual velocity analysis of Applicant's equation (1) produces the formula of Applicant's equation (5) for determining depth residual for a one-dimensional medium in the depth-offset domain, or more to the point, at the selected horizon, the depth residuals are calculated with respect to offset. Equation (5) stands in contrast to equation (1) which provides a formula for determining residual velocity in the depth-ray parameter domain and thus requires subsequent mapping to the depth-offset domain. Ahmed shows calculation of depth residuals with respect to ray parameter, as is consistent with equation (1), and then maps the horizon into the depth-offset domain.

Selecting the horizon and performing the residual velocity in the offset-depth domain are not meaningless or trivial distinctions between the claimed invention and Ahmed. Ahmed discloses that the residual velocity analysis and subsequent migration depth corrections are performed in the depth-ray parameter domain, not in the offset-depth domain, and such analysis and depth correction are then mapped to the offset-depth domain. The purpose of such analysis and mapping as described in Ahmed is so that it is not necessary to do a top-down layer stripping migration to isolate the interval velocity corrections. See Ahmed in the abstract and in the description of equations (9) and (10). By contrast, the Applicant's claimed method includes residual velocity analysis to at least a first selected horizon. After the residual velocity analysis to the first selected horizon, the depth and thickness of the first selected horizon are updated. The process may, if desired, continue to a second, deeper horizon. See the Applicant's specification beginning at paragraph [0028]. More particularly, in paragraph [0040], the Applicant's specification states that:

> [t]o obtain interval velocities using the above process, a top-down "layer stripping" technique is used. After performing the foregoing residual velocity analysis along a first selected horizon (layer) based on the initial

velocity model used for the depth migration, velocities $V^m(x)$ for the first layer are updated to $V^{new}(x)$

which top down layer stripping technique is the exact procedure that Ahmed purports to avoid. Such processing as recited in amended claim 1 is different than processing in the depth-ray parameter domain, with subsequent mapping, as disclosed in Ahmed. A possible advantage of using the Applicant's claimed method is greater stability in an inversion process, one embodiment of which is recited in claim 3, to determine the most likely value of interval velocity. Further, by analyzing residual velocities with respect to one or more selected horizons in the seismic data, it is believed that the results of the Applicant's claimed method are more likely to correspond to actual subsurface Earth formation structure and composition, because seismic horizons frequently correspond to subsurface Earth formation features. It is also believed that the velocity analysis according to the Applicant's claimed invention is less likely to fail to converge to a correct result, referred to as being more "stable" than the processing technique disclosed in Ahmed. Such horizon-based analysis is neither disclosed nor fairly implied in Ahmed. Based on the foregoing, the Applicant believes that claim 1 is not anticipated by Ahmed.

Further, it does not appear to be the case that a person of ordinary skill in the art would be able to devise the invention of claim 1 merely by modifying Ahmed, if for no other reason than Ahmed does not provide any information on how to process seismic data directly and completely in the offset-depth domain.

4. Claim rejections - 35. U.S.C. § 103(a)

Claims 1-6 stand finally rejected as obvious over Bevc et al. (U.S. Patent Application Publication No. 2002/0042678 A1) in view of Ahmed. To the extent the rejection may still apply with respect to claim 1 as amended the rejection is respectfully traversed for following reasons.

First, the Applicant has shown that there is a distinction between residual velocity analysis in the ray-parameter domain (and subsequent mapping to the depth-offset domain) and residual velocity analysis directly and completely in the depth-offset

domain. Ahmed specifically states that the technique disclosed therein may eliminate the need to perform top-down layer stripping. Applicant notes that Bevc et al. discloses what is in fact a horizon based velocity analysis technique. There is no reason to combine a mapping technique relating to non-horizon based velocity analysis with horizon based velocity analyzed data. Applicant also notes that the velocity analysis technique disclosed in Bevc et al. is performed in the ray-parameter-incident angle domain, and not directly and completely in the offset-depth domain.

Second, the mapping technique shown in Ahmed, which maps data in the depth-ray parameter domain to the depth-offset domain is not the same as mapping data in the ray-parameter-angle domain to the depth-offset domain as is performed according to Bevc et al. Therefore, combining the disclosures of Ahmed and Bevc et al. does not provide all the elements of the Applicant's invention of amended claim 1.

Third, as the Examiner correctly noted, Bevc et al. discloses a method for determining a velocity model in the ray parameter-angle domain. However, the method disclosed in Bevc et al. is performed using an analysis technique called "straight ray". Straight ray velocity analysis operates using the assumption that seismic energy travels in essentially straight line paths from the seismic source, to a reflector in the Earth's subsurface, and back to a seismic receiver near the Earth's surface. Straight ray analysis therefore avoids the complication of calculating a seismic energy travel path that takes account of acoustic energy refraction (bending) due to velocity change as the seismic energy travels through the various subsurface Earth formations. The advantage of straight ray analysis is simplicity and economy in the use of computation resources. However, as may be readily inferred, straight ray analysis is thought to be less accurate than so-called "ray-bending" velocity analysis techniques, such as various embodiments of the Applicant's invention, which account for both the velocity and changes in seismic energy travel path resulting from velocity-based refraction. Therefore, merely combining Ahmed with Bevc et al. would not produce the result of the Applicant's claimed invention, if for no other reason than mere mapping of a straight ray velocity analysis with a ray parameter mapping technique would likely provide less accurate results than the Applicant's claimed

invention. Accordingly, the Applicant believes that the invention of claim 1 as amended is not obvious over Bevc et al. in view of Ahmed.

Claims 2-6 ultimately depend from claim 1 and are believed to be patentable over the art of record for at least the same reasons advanced with respect to claim 1.

The Applicant believes that this Reply is full responsive to each and every ground of rejection cited in the Office Action of December 21, 2005, and respectfully requests early favorable action on this application.

Respectfully submitted,

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Richard A. Fagin

Richard A. Fagin, Reg. No. 39,182
P.O. Box 1247
Richmond, TX 77406-1247

Counsel of Record
E. Eugene Thigpen, Reg. No. 27,400
Petroleum Geo-Services, Inc.
P.O. Box 42805
Houston, Texas 77242-2805
Telephone: (281) 509-8000
Facsimile: (281) 509-8085